Pembroke Power Station: Report to Inform Appropriate Assessment (RIAA)

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RWE Generation UK plc

Pembroke Power Station Abstraction Licence Renewal
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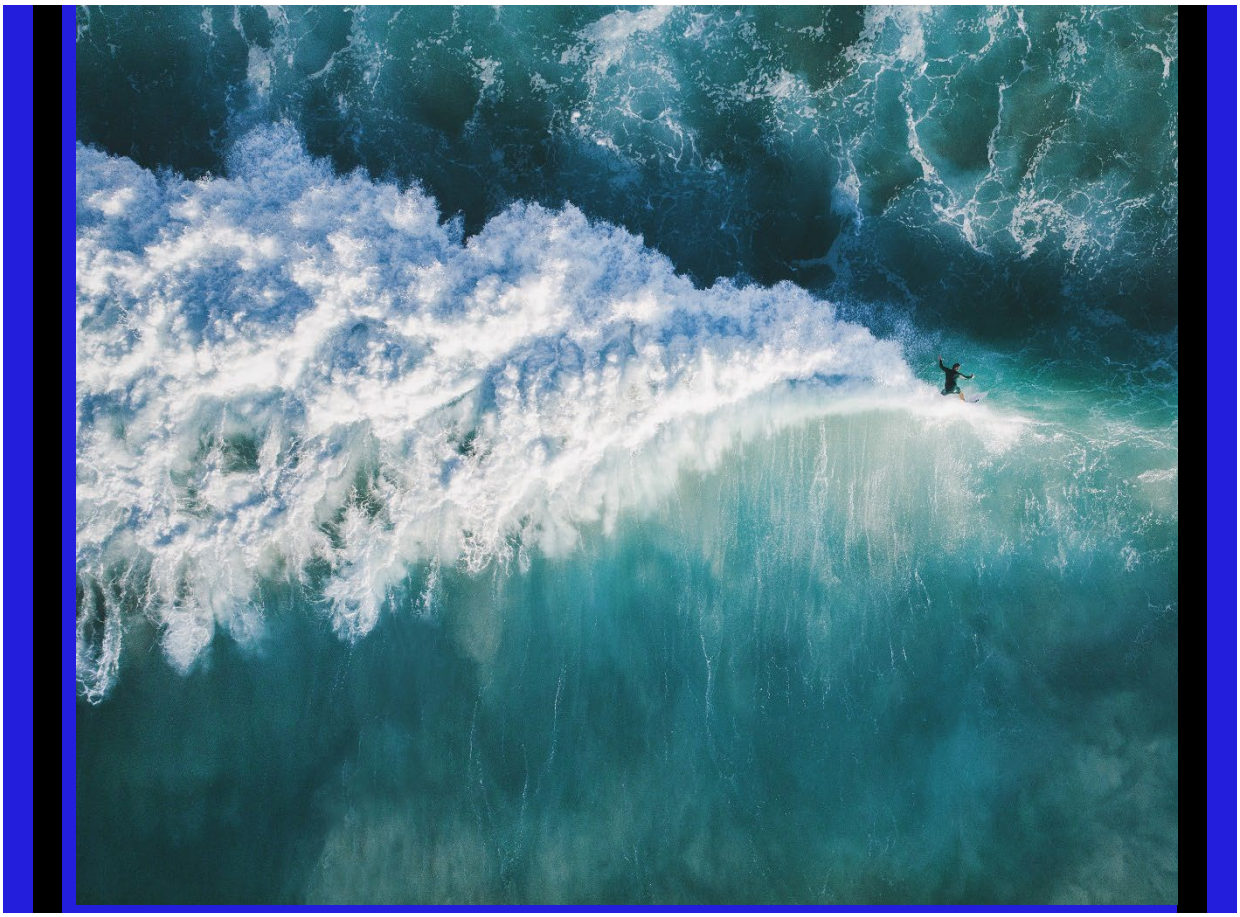

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1. Background

1.1 Project Description

Water is abstracted year-round from Pennar Gut for non-evaporative cooling of RWE Generation UK plc's (RWE) Pembroke Power Station. Cooling water is drawn from Pennar Gut, at the mouth of the Pembroke River. The current licence (see below) is due to expire on the 31st March 2025.

The existing licence (22/61/06/0156) was originally granted by Environment Agency Wales (EAW) on the 3rd February 2009, and reissued by National Resource Wales (NRW) on the 21st November 2014 to reflect the change in name of the Competent Authority. The licence allows for the following maximum quantities of water to be abstracted from Pennar Gut, Pembroke Dock (NGR SM9365402652):

- 144,000 cubic metres per hour
- 3,456,000 cubic metres per day
- 1,200,000,000 cubic metres per year
- at an instantaneous rate not exceeding 40 cubic metres per second.

The proposed water Abstraction Licence Renewal for Pembroke Power Station is intended as a 'like for like' renewal, with no changes to the current licenced volumes of abstracted sea water, nor changes to the conditions attached to the licence. For avoidance of doubt, the renewal will enable the continued operation of Pembroke Power Station in the same way as already authorised.

1.2 Purpose of this Report

This document sets out the evidence to inform the competent authority's Habitats Regulation Assessment for the Pembroke Power Station abstraction license renewal (herein referred to as the Abstraction Licence Renewal). The purpose of this report is to address and record the reasoning and conclusions in relation to the first two tests of Article 6(3) of the European Union (EU) Habitats Directive 92/43/EEC (hereafter referred to as 'the Habitats Directive'), which include:

i. *'whether a plan or project is directly connected to or necessary for the management of the site, and*

ii. *Whether a plan or project, alone or in combination with other plans and projects, is likely to have significant effects on a Natura 2000 site in view of its conservation objectives.'*

Further detailed information on the HRA process is provided in Section 2 and Section 3 of this report.

A comprehensive Habitats Regulation Assessment was undertaken to inform the Competent Authority's original determination of the Abstraction Licence and Environmental Permit applications which were granted in 2009 & 2011 respectively (22/61/6/0156 & EPR/DP3333TA).

1.3 Background to Habitats Regulations Assessment

The Habitats and Birds Directives provide the European legal framework for the protection of wild fauna and flora and birds. Under EC Council Directive 92/43/EEC (EC 1992) on the conservation of natural habitats and of wild fauna and flora (the 'Habitats Directive') and Council Directive 2009/147/EC (EC 2009) on the conservation of wild birds (The Birds' Directive), a network of protected areas for certain habitats and species of conservation importance (those listed on Annexes I and II of the Directives) was established by EU member states; known as European sites.

This network of European sites, known as the 'Natura 2000 Network', comprises SPAs and SACs and form a national site network within the UK. SACs are designated under the 'Habitats Directive' for supporting habitats or species listed on Annex I or II of the Directive. SPAs are designated under the 'Birds Directive.'

Articles 6(3) and 6(4) of the Habitats Directive require an assessment to be undertaken for plans and projects that are likely to have a significant effect, alone or in-combination with other plans and projects, on European sites.

The Conservation of Habitats and Species Regulations 2017 (the Habitats Regulations) transpose the Habitats Directive into UK law. Section 63(1) the Habitats Regulations requires that:

'A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which—

> *(a) is likely to have a significant effect on a European Site or a European offshore marine site (either alone or in-combination with other plans or projects), and*
>
> *(b) is not directly connected with or necessary to the management of that site,*

must make an appropriate assessment of the implications of the plan or project for that site in view of that site's conservation objectives.'

These requirements underlie the decision-making tests for plans and projects likely to affect European sites that have been applied in this report.

The assessment of plans or projects that may affect European sites is generally acknowledged to follow a four-stage process:

- **Stage one: Screening** — the process which identifies the likely impacts upon a European site from a project or plan, either alone or in-combination with other projects or plans and considers whether these impacts are likely to be significant.
- **Stage two: Appropriate Assessment** — the consideration of the impact on the integrity of the European site from the project or plan, either alone or in-combination with other projects or plans, with respect to the site's structure and function and its Conservation Objectives. Additionally, where there are adverse impacts, an assessment of the potential mitigation of those impacts is undertaken.
- **Stage three: Assessment of Alternative Solutions** — the process which examines alternative ways of achieving the objectives of the project or plan that avoid adverse impacts on the integrity of the European site. All reasonable alternatives must have been considered and assessed, and the least damaging option selected, to progress to Stage 4.
- **Stage four: Imperative Reasons of Overriding Public Interest (IROPI)/Derogation** – Assessment where no alternative solutions exist, and adverse impacts remain. Assessment of compensatory measures where, in the light of an assessment of imperative reasons of overriding public interest (IROPI), it is deemed that the project or plan should proceed.

1.4 European Sites

European Sites are defined in the Habitats Regulations as Sites of Community Importance (SCIs), SACs, candidate Special Areas of Conservation (cSACs) and SPAs. In UK planning policy[1], the term 'European site' is also deemed to include proposed SACs, potential SPAs and listed or proposed Ramsar wetland sites of international importance, as well as areas secured as sites compensating for damage to a European site. This wider definition is applied in this report.

[1] Habitats regulations assessments: protecting a European site – GOV.UK 2023. Available at: https://www.gov.uk/guidance/habitats-regulations-assessments-protecting-a-european-site

1.5 Structure of this Report

Natural Resources Wales, as the relevant Competent Authority for the authorisation of abstraction licences under the Water Resources Act 1991, will undertake a HRA of the project, as required under the Habitats Regulations. This report was prepared to inform the HRA and is structured as follows:

- Section 1 provides a description of the project;
- Section 2 describes the methodologies followed in this report;
- Section 3 presents the results and concludes Stage one (Screening); and
- Section 4 to 8 provides information for Stage two (Appropriate Assessment).

2. Assessment Methodology

The Habitat Regulations require Natural Resource Wales, as the Competent Authority under the Habitats Regulations and Water Resources Act 1991, to determine whether the project will have any Likely Significant Effects (LSE) on European Sites, with reference to the site's conservation objectives. If a significant effect is considered likely, then an Appropriate Assessment must be undertaken.

The process of HRA involves an initial 'Screening' stage. The Screening stage identifies the possibility of impacts from a proposal occurring, directly or indirectly, to European site features.

The purpose of Screening is to identify whether, activities associated with plans or projects not directly connected with or necessary to the management of a European Site, either acting individually or in-combination with other plans or projects, could result in Likely Significant Effects (LSEs) on any European Sites. All potential effects between activities associated with the plans or projects and the ecological components of European Sites must be considered. This includes potential effects on mobile species, notably birds, mammals, invertebrates and migratory fish. At Screening, the burden of evidence is to show, on the basis of objective information, and beyond reasonable scientific doubt, that the proposed plan or project will have no LSEs on a European Site. If the effect is significant, or is not known, it would trigger the need for Stage 2 (Appropriate Assessment). Where there is uncertainty on this point, the precautionary principle applies, the protection of the site takes priority and stage 2 would be triggered.

In the context of Screening, when applying the "test of significance", the test is of the "likelihood" of effects rather than the "certainty" of effects. In accordance with the Waddenzee Judgement (Case C-127/02), a likely effect is one that cannot be ruled out based on objective information and is underpinned by the precautionary principle and the test of beyond reasonable scientific doubt. This test therefore sets a low bar: a project or plan should be considered "likely" to have an effect if the competent authority is unable (on the basis of objective information) to exclude the possibility that the project or plan could have significant effects on any European Site, either alone or in-combination with other plans or projects. An effect is considered to be 'significant' if it could undermine a European Site's conservation objectives.

The outcome of the Screening study informs the requirement for mitigation measures and the need for further assessment (Appropriate Assessment) at Stage two of the HRA process. The Appropriate Assessment should identify mitigation and/or avoidance measures which eliminate or reduce the effects. If Appropriate Assessment is required, the competent authority then considers the effects of the project or plan on the integrity of the European Site(s), specifically it must be determined if the project or plan will adversely affect the integrity of a European Site(s) either individually or in-combination with other plans and projects in view of the site conservation objectives. Where potential adverse effects on site integrity are identified, mitigation measures are proposed to avoid adverse effects, as appropriate.

Following Appropriate Assessment, including any necessary mitigation proposals, if adverse effects on site integrity remain, or uncertainty remains and the project/plan is to be progressed, an Assessment of Alternative Solutions (i.e. Stage 3 of the HRA process) is required under the provisions of Article 6(4) of the Habitats Directive. This process examines the alternative ways of achieving the objectives of the project or plan that avoid adverse impacts on the integrity of the European Site. If no alternatives exist, or all alternatives would result in adverse effects on the integrity of a European Site, then either the process moves to the next stage (Stage 4 – Imperative Reasons of Over-riding Public Interest (IROPI)) or the project or plan should be abandoned. If in the light of an assessment of IROPI, it is deemed that the project or plan should proceed, compensatory measures are implemented to maintain the coherence of the Natura 2000 network in the face of adverse effects to the integrity of the site(s).

This document is a report to inform an Appropriate Assessment and comprises Stage one (Screening) and Stage two (Appropriate Assessment) of the HRA process.

3. The HRA Process: Stage 1 – Screening

3.1 Introduction

Stage 1 - Screening has been informed by a desk study of all relevant environmental information and involved the following steps:

- Determination if the proposed plan (i.e. the Abstraction Licence Renewal) is directly connected with or necessary to the management of a European Site (Section 3.2);
- Assessment of Likely Significant Effects (LSEs) on European Site(s) (Sections 3.5 to 3.7);
    - Identification of pathways to effect;
    - Identification of relevant European Sites;
    - Assessment of the project alone;
    - Assessment of the project in-combination (where no LSE alone identified); and
- Determination on the need for AA (Section 3.8).

The purpose of this section is to assess or 'screen' the Abstraction Licence Renewal to judge whether LSEs on a European Site can or cannot be ruled out. Where the absence of information gives rise to uncertainty, it may be necessary to assume an impact in order to give effect to the precautionary principle.

3.2 Is the Abstraction Licence Renewal Exempt from HRA?

The overarching objective of the Abstraction Licence Renewal is not related to the nature conservation management of the European Sites, but to provide cooling water to the operation of Pembroke Power Station in order to promote affordability of electricity prices and ensure security of supply. Therefore, the Abstraction Licence Renewal is not considered to be connected with or necessary to the management of European Sites. As such, it not an exempt activity and it is necessary to proceed with assessment.

3.3 Assessment of Likely Significant Effects

3.3.1 Identification of source-receptor pathways on European Sites

All European sites identified in the Habitats Regulations and in UK policy with the potential to be affected by the project must be initially considered (screened). This study considered European sites within, or immediately adjacent to the project area. This study also considered potential connectivity to more distant sites outside the project area that could be affected via hydrological pathways (e.g., those upstream, or downstream) or connectivity via mobile species.

Table 3-1: European Sites considered at Screening

European Site	Distance from abstraction	Qualifying Interests
Pembrokeshire Marine / Sir Benfro Forol SAC (UK0013116)	0km	Large shallow inlets and bays [1160] Estuaries [1130] Reefs [1170] Atlantic salt meadows (*Glauco Puccinellietalia maritimae*) [1330] Mudflats and sandflats not covered by seawater at low tide [1140] Coastal lagoons [1150] Submerged or partially submerged sea caves [8330] Sandbanks which are slightly covered by seawater all the time [1110] Grey seal (*Halichoerus grypus*) [1364] Allis shad (*Alosa alosa*) [1102]

European Site	Distance from abstraction	Qualifying Interests
		Twaite shad (*Alosa fallax)* [1103] River lamprey (*Lampetra fluviatilis)* [1099] Sea lamprey (*Petromyzon marinus*) [1095] Otter (*Lutra lutra*) [1355] Shore dock (*Rumex rupestris*) [1441]
Pembrokeshire Bat Sites and Bosherton Lakes SAC (UK0014793)	4km	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp [3140] Greater horseshoe bat (*Rhinolophus ferrumequinum*) [1304] Lesser horseshoe bat (*Rhinolophus hipposideros) [*1303] Otter (*Lutra lutra)* [1355]
West Wales Marine SAC (UK0030397)	9km	Harbour porpoise (*Phocoena phocoena*) [1351]
Affonydd Cleddau/ Cleddau Rivers SAC (UK0030074)	17.5 km	Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] Active raised bogs [7110] Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0] Brook lamprey (*Lampetra planeri*) [1096] River lamprey (*Lampetra fluviatilis*) [1099] Bullhead (*Cottus gobio*) [1163] Otter (*Lutra lutra*) [1355] Sea lamprey (*Petromyzon marinus*) [1095]
Castlemartin Coast SPA (UK9014061)	4.2km	Chough (Pyrrhocorax pyrrhocorax)
Skomer, Skokholm and the Seas off Pembrokeshire SPA (UK9014051)	15 km	European storm petrel (*Hydrobates pelagicus*) Red-billed chough (*Pyrrhocorax pyrrhocorax*) Short-eared owl (*Asio flammeus*) Manx shearwater (*Puffinus puffinus*) Atlantic puffin (*Fratercula arctica*) Lesser black-backed gull (*Larus fuscus*) Seabird assemblage of international importance

To determine whether a potential source and pathway were relevant to a European site, the geographical location and nature of the receiving environment were considered. This included an appraisal of each identified European site's ecology and specific vulnerability to the expected level and nature of anticipated effects.

3.3.2 Approach to Mitigation

The recent People Over Wind, Peter Sweetman v Coillte Teoranta case has ruled that mitigation cannot be considered at the screening stage of a HRA and this has been taken into account within the screening assessment provided in this Report to Inform an Appropriate Assessment (RIAA). Only 'standard' measures for protecting the environment are referred to where they are a matter of good practice and / or because of other statutory, legal or health and safety requirements. This is because they have been incorporated irrespective of whether a European site might be affected i.e., although they may incidentally provide some benefit to a European site, their inclusion and purpose is not to avoid or reduce harmful effects on the site (Tyldesley and Chapman 2013). This approach accords with accepted methodology.

For this project, the inclusion of coarse and fine screening of the abstraction and fish protection measures (Acoustic fish Deterrent and Fish Recovery and Return) are incorporated into the design as they are an integral part of the existing abstraction infrastructure, considered a requirement of all coastal /estuarine water abstractions (regardless of designation) and not directly related to the presence of the protected sites

in the estuary or adjacent coastal waters. Consistently with accepted methodology these measures have been taken into account at the screening stage.

3.3.3 Identification of Zone of Influence

A Zone of Influence (ZoI) approach has been used to inform the HRA screening stage which takes account of all relevant receptors. For the purposes of the HRA assessment, a receptor is defined as a quality interest of the European site, or component of a qualifying feature that could potentially be affected by the project. Taking into consideration the relevant activities and potential impact pathways the following ZoIs have been defined:

- For highly mobile qualifying features (birds), the ZoI is defined as each species' normal foraging distance.
- For migratory fish the ZoI is based on the migration route for each species. The downstream boundary is the point at which they leave the coast and enter the estuary, i.e., the downstream limit of Milford Haven. From this point onwards migratory fish have the potential to be affected by the abstraction as they will swim past it. The upstream limit is the furthest point at which the species is known to be present, which may differ for individual species.
- For resident estuarine fish the ZoI is defined as the water body limits of Milford Haven (Milford Haven Outer – GB641008220000 and Milford Haven Inner GB531006114100) .
- For passive fauna (e.g., early life-stages of fish) the distance of the tidal excursion in the vicinity of the intake has been estimated. The maximum ZoI for passive fauna therefore extends 10km.

Consideration was then given to European site features located within the ZoIs. With reference to the specific vulnerabilities of the features present and the extent of physical changes that could arise from proposed activities; a determination was made for the potential for LSEs[2]. All project activities were assessed for their potential to lead to LSEs via the pathways previously identified. If the risk of LSE to qualifying features of a European site could not be discounted, then the site would require consideration at Stage two, Appropriate Assessment.

3.3.4 Identification of Project activities and potential effect pathways

Potential effects on European Sites from the Abstraction Licence Renewal were considered taking a source-pathway-receptor approach. This approach identifies the potential impacts that could occur and determines whether a pathway exists for that impact to affect the qualifying interests (QI) of the site, taking into account proximity to European Sites, the level of effect known from the existing abstraction licence , and the sensitivity of the receptors.

Table 3-2: Identification of potential impacts as a result of the proposed abstraction licence.

Source	Pathway	Receptor	Zone of Influence (ZoI)
Abstraction of water	Loss of juvenile and adult fish and invertebrates through impingement	Piscivorous birds, fish and mammals – loss of prey resource Typical aquatic communities associated with QI habitats – direct mortality	For piscivorous birds, typical foraging ranges will be used as potential ZoI. For resident estuarine fish the ZoI is defined as the water body limits of Milford Haven Inner and Outer waterbodies (approximately 12km downstream and 21.9km upstream). For migratory fish the ZoI is based on the migration route for each species. The downstream boundary is the point at which they enter the estuary. From this point onwards migratory fish have the potential to be affected by the

[2] The terms 'likely' and 'significant' have been interpreted with reference to case law, including the Waddenzee Judgment (Landelijke Vereniging tot Behoud van de Waddenzee and Nederlandse Vereniging tot Bescherming van Vogels v Staatssecretaris van Landbouw, Natuurbeheer en Visserij (C-521/12)) and Sweetman case (Sweetman v An Bord Pleanála (C.M.L.R. 16)).

Source	Pathway	Receptor	Zone of Influence (ZoI)
			abstraction as they pass it. The upstream limit is the furthest point at which the species is known to be present, which may differ for individual species.
	Loss of larval fish and invertebrates through entrainment	Piscivorous birds, fish and mammals – loss of adult equivalent prey resource Typical aquatic communities associated with QI habitats – direct mortality	For passive fauna (e.g., early life-stages of fish and invertebrates) the distance of the tidal excursion in the vicinity of the intake has been calculated based on the currents that a particle would experience on a spring tide. The ZoI for passive fauna therefore extends approximately 10 km. This encompasses the maximum area considered at risk to larval fish and invertebrate entrainment due to passive transport by normal tidal flows.
	Change to water velocity in the vicinity of the intake	Sediment granulometry and habitat types	Intake channel

3.3.5 Identification of European Sites Potentially Affected

As described above, the screening of European Sites has taken into account the Abstraction Licence Renewal and the potential pathways to effects in respect to those European Sites in proximity (i.e. within the ZoI). It should be noted that where European Sites fall beyond the ZoI there is considered to be no potential pathways for effects (including LSEs).

Table 3-3 identifies the potential for LSE on European Sites arising from the Abstraction Licence Renewal.

Table 3-3: Potential LSE on European Sites arising from the Abstraction Licence Renewal.

European Site	Qualifying Interests	Distance from abstraction point	Effects Pathway Commentary	Likely Significant Effect (LSEs)
Pembrokeshire Marine / Sir Benfro Forol SAC (UK0013116)	Large shallow inlets and bays [1160] Estuaries [1130] Reefs [1170] Atlantic salt meadows (*Glauco Puccinellietalia maritimae*) [1330] Mudflats and sandflats not covered by seawater at low tide [1140] Coastal lagoons [1150] Submerged or partially submerged sea caves [8330] Sandbanks which are slightly covered by seawater all the time [1110] Grey seal (*Halichoerus grypus*) [1364] Allis shad (*Alosa alosa*) [1102] Twaite shad (*Alosa fallax)* [1103] River lamprey (*Lampetra fluviatilis)* [1099] Sea lamprey (*Petromyzon marinus*) [1095] Otter (*Lutra lutra*) [1355] Shore dock (*Rumex rupestris*) [1441]	0km	Large shallow inlets and bays, reefs, Atlantic sea meadows, coastal lagoons, sea caves and sandbanks are reported at sufficient distance from the abstraction location to lie outside of the ZoI from the Abstraction Licence pathways to effect. Grey seal, Allis /Twaite shad, otter and shore dock are all considered to be in Favourable condition under the current abstraction licence and therefore a same terms renewal will not result in LSE on these features. Estuaries, mudflats and sandflats not covered by seawater at low tide, river lamprey and sea lamprey may all be present in the ZoI of the Abstraction Licence Renewal. Estuaries (including typical fish communities) habitat may be affected by 12oldsinny hydrological changes in the vicinity of the intake infrastructure and entrapment. River and sea lamprey are known from the Pennar Gut and at risk from entrapment. Therefore, there exists a potential pathway to effect on these QI.	Potential for LSE on Estuaries, mudflats and sandflats and sea and river lamprey.
Pembrokeshire Bat Sites and Bosherton Lakes SAC (UK0014793)	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp [3140] Greater horseshoe bat (*Rhinolophus ferrumequinum*) [1304] Lesser horseshoe bat (*Rhinolophus hipposideros) [*1303] Otter (*Lutra lutra)* [1355]	4km	There is no pathway to effect from the Abstraction Licence Renewal on qualifying habitats. Bat species will not use Milford Haven as a foraging resource. The abstraction point lies 4km from the nearest point to the European site. Although otters can range some distance (e.g. 20km) along a river, it is considered that owing to the distance over connecting habitat to the Pembroke River it is unlikely that individuals from this site would be reliant on foraging within Pennar Gut when the Bosherton Lakes and south Pembrokeshire coast is immediately available to the SAC population.	No LSE on any QI

European Site	Qualifying Interests	Distance from abstraction point	Effects Pathway Commentary	Likely Significant Effect (LSEs)
West Wales Marine SAC (UK0030397)	Harbour porpoise (*Phocoena phocoena*) [1351]	9km	The SAC lies 9km west of the mouth of the Milford Haven and extends along the Welsh coast. Although harbour porpoise are a mobile species and sighted within the Haven regularly (Milford Haven Port Authority, 2021), their main populations lie within the SAC. Therefore, it is unlikely that Milford Haven provides critical foraging habitat. As a result, harbour porpoise SAC populations are outside of the zone of influence. Harbour porpoise are considered to be in Favourable condition under the current abstraction licence and therefore a same terms renewal will not result in LSE on these features.	No LSE
Affonydd Cleddau/ Cleddau Rivers SAC (UK0030074)	Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260] Active raised bogs [7110] Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) [91E0] Brook lamprey (*Lampetra planeri*) [1096] River lamprey (*Lampetra fluviatilis*) [1099] Bullhead (*Cottus gobio*) [1163] Otter (*Lutra lutra*) [1355] Sea lamprey (*Petromyzon marinus*) [1095]	17.5 km	No pathway to effect to fully freshwater, terrestrial or groundwater dependent habitats (watercourses of plain to montane levels, active raised bogs, alluvial forests), nor species only reported from freshwater habitats (brook lamprey and bullhead). Otter are considered to be in Favourable condition under the current abstraction licence and therefore a same terms renewal will not result in LSE on these features. River and sea lamprey undertake catchment wide migrations through the lower Cleddau and have been reported from entrapment surveys of the existing abstraction licence. There is the potential for these species therefore to interact with the intake and these QI are screened in to Stage 2.	**Potential for LSE on sea and river lamprey.**
Castlemartin Coast SPA (UK9014061)	Chough (Pyrrhocorax pyrrhocorax)	4.2km	No direct or indirect effects predicted on breeding, foraging or roosting habitats of chough from the abstraction of estuarine water.	No LSE
Skomer, Skokholm and the Seas off Pembrokeshire SPA (UK9014051)	European storm petrel (*Hydrobates pelagicus*) Red-billed chough (*Pyrrhocorax pyrrhocorax*) Short-eared owl (*Asio flammeus*) Manx shearwater (*Puffinus puffinus*) Atlantic puffin (*Fratercula arctica*) Lesser black-backed gull (*Larus fuscus*) Seabird assemblage of international importance	15 km	No direct or indirect effects predicted on breeding, foraging or roosting habitats of chough or short eared owl from the abstraction of estuarine water. The impingement or entrainment of prey items may result in a potential pathway to effect on piscivorous bird species. These have been screened in on a precautionary basis to Stage 2	No LSE on chough or short eared owl **Potential for LSE on storm petrel, Manx shearwater, puffin, lesser black-backed gull and seabird assemblages of international importance**

Based on the approach outlined above, the potential for LSE has been identified for three European sites, two SAC (Pembrokeshire Marine and Cleddau Rivers) and one SPA (Skomer, Skokholm and the Seas off Pembrokeshire). These sites, are therefore required to be included in Stage 2 of the HRA process where in-combination effects will be reviewed.

3.4 Summary of Stage 1 Screening

Pathways to effect arising from the Pembroke Abstraction Licence Renewal have the potential to effect three European sites and therefore LSE cannot be excluded.

Likely Significant Effects were predicted or could not be ruled out for the following sites and receptors, through the entrapment of aquatic fauna and changes to water velocity (Table 3-4).

Table 3-4 Summary of Stage 1 Screening.

European Site	Qualifying Interests	Potential LSE (alone)
Pembrokeshire Marine / Sir Benfro Forol SAC (UK0013116)	Estuaries [1130] Mudflats and Sandflats [1140] River lamprey (*Lampetra fluviatilis)* [1099] Sea lamprey (*Petromyzon marinus*) [1095]	Potential for LSE
Affonydd Cleddau/ Cleddau Rivers SAC (UK0030074)	River lamprey (*Lampetra fluviatilis*) [1099] Sea lamprey (*Petromyzon marinus*) [1095]	Potential for LSE
Skomer, Skokholm and the Seas off Pembrokeshire SPA (UK9014051)	European storm petrel (*Hydrobates pelagicus*) Manx shearwater (*Puffinus puffinus*) Atlantic puffin (*Fratercula arctica*) Lesser black-backed gull (*Larus fuscus*) Seabird assemblage of international importance	Potential for LSE

Therefore, in accordance with Article 6(3) of the Habitats Directive, a Stage 2 Appropriate Assessment of the Abstraction Licence Renewal is required.

4. Appropriate Assessment

4.1 Approach

This section of the report provides information for the competent authority to undertake Stage 2 of the HRA process (called the integrity test in the updated HRA Guidance). This considers whether LSE identified at Stage 1 (screening), will adversely affect the integrity of the sites in relation to their Conservation Objectives. Tyldesley and Chapman (2013) define the integrity test as "the coherence of its ecological structure and function, across its whole area, which enables it to sustain habitat, complex of habitats and/or the levels of populations of the species for which the site is (or will be) designated".

The information collected and outlined in this section determines the potential for adverse effects on site integrity from the Abstraction Licence Renewal by:

- Giving an overview of the European sites identified at risk, and provision of further information on the screening of sites and their Qualifying Interests (QI);
- Presenting information on the Conservation Objectives and an understanding of current factors which either maintain or threaten those Conservation Objectives;
- Assessing aspects of the project proposals which could undermine the Conservation Objectives and integrity of European sites;
- Where potential impacts are identified, providing specific mitigation measures that will be implemented to ensure adverse effects on European Sites can be avoided; and
- Describing the project proposals and other plans or projects that may have an in-combination effect on any European Sites.

5. European Sites

5.1 Sites Screened into Stage 2 AA

The AA Screening Report identified potential LSE on three European Sites, two SACs and one SPA, as a result of the Abstraction Licence Renewal.

5.1.1 Pembrokeshire Marine SAC (UK0013116)

Designated in 2004 the Pembrokeshire Marine SAC covers an area of 138,038ha, encompassing the entirety of the western Pembrokeshire coastline and extending through Milford Haven to the tidal limits of the Cleddau, Cresswell and Carew Rivers. In doing so, the European sites supports a wide range of marine and estuarine habitats and species. Of particular note are the large shallow inlets and bays, reefs and grey seal populations, considered as some of the best areas in the UK. Other qualifying interests are considered to support a significant UK presence. Of those features screened in the European site supports a wide diversity of communities and species, with high species diversity, particularly tide swept communities and intertidal mudflats are particularly important. The SAC supports habitats suitable for migratory species that both reside within, and move through, the European Site at different times of the year.

5.1.1.1 Estuaries and mudflats and sandflats

The Estuaries feature comprises the inner and outer Haven and the integral mudflat, sandflat and Atlantic saltmarsh components.

In terms of the condition of this feature, it has been affected by chemical contamination, driven by mercury and its compounds and by tributyltin (TBT) and its compounds. NRW state that contaminant levels in sediments have been reported as high in the Haven which can be attributed to reworking of historic contaminants (e.g. from disturbance by construction and dredging as there have been efforts to reduce pollution sources. Levels of certain contaminants are above statutory guideline concentrations (Little and Galperin, 2014 in NRW, 2018) although hydrocarbon contaminant loads are thought to be decreasing (Little, 2009, in NRW, 2018). However, there have been oil spills (e.g. Sea Empress) and continued presence and reworking of oil within the sediments. TBT levels remain high (but the trend is downwards) but pressure from use of antifoulants remains. The mudflats and sandflats feature is distributed extensively around Pennar Gut and Milford Haven. Such mudflats support large areas of pioneer saltmarsh and Atlantic salt-meadows. The mudflats in Milford Haven in particular are considerably constrained by the geomorphology, accreting slowly in places but expansion is generally restricted by channel structure throughout the waterway. Overall these are considered a dynamic feature of the SAC as a result of hydrodynamic and sediment transport processes, sediment supply and coastal morphology.

NRW (2018) state that the exposure of intertidal mudflats to wave action varies within the Haven. The mudflats in Pennar Gut have a degree of shelter from wave action. Subsurface sediment water and water chemistry are primarily determined by tidal seawater influence, surface and coarse-grained sediments are potentially strongly influenced by air temperature, precipitation and wind. The intertidal mudflats and sandflats are distributed across salinity gradients from fully saline to almost freshwater. Muddy sediments in the upper reaches of the site's estuaries are generally of very low salinity, increasing along a gradient towards fully saline on the open coast. The sediment surface salinity is inherently variable, varying with rainfall, evaporation and tides. Subsurface interstitial salinity and oxygen concentrations vary with sedimentary and biological processes. The overall species diversity of intertidal mudflats is high but varies considerably between and within communities, sediment types and individual sediment flats.

5.1.1.2 Lamprey

River lamprey inhabit estuaries and inshore waters for 1-2 years and travel up through Milford Haven past Pennar Gut on their spawning migration to the River Cleddau, entering the river in October-December. Once hatched, the larvae (ammocoetes) spend several years buried in riverine sandy sediment feeding on organic matter before metamorphosing after 3-4 years. The juveniles then migrate into the estuary in spring and

sometimes in autumn and are considered to be present in Milford Haven all year round. River lamprey feed parasitically in the marine phase and their diet consists of estuarine and marine fish, namely herring, sprat and flounder, the latter two species are likely to be the primary food source owing to their abundance in the Haven (NRW, 2018).

Sea lamprey have been recorded 400km offshore and at depths of up to 1000m. Varying life stages are likely to be present in Milford Haven all year. Adult sea lamprey travel up through the estuary from April to June past Pennar Gut on their spawning migration to the River Cleddau. Peak migration usually occurs when water temperatures are consistently above 10 ºC and continues until temperatures reach 18ºC. The juveniles migrate downstream between December and June, feeding parasitically in the Haven before travelling offshore where they target larger prey. It has been suggested that juveniles prefer migratory species in the freshwater/estuarine environment, including shad. Host prey in general includes bony fish, elasmobranchs and cetaceans demonstrating that selection is size rather than taxon specific. Sea lamprey are not restricted to a specific habitat and are more likely to follow prey, although it is indicated that demersal species and sheltered habitat is preferred (NRW, 2018).

It should be noted that lamprey do not necessarily return to their breeding river, so lampreys using the SAC are considered part of a larger population covering the Bristol Channel and potentially beyond.

5.1.2 Cleddau Rivers SAC (UK0030074)

The Cleddau Rivers SAC first designated in 2004 covers an area of 751ha, covering a broad range of freshwater, wetland and terrestrial habitats. The freshwater habitats support important populations of migratory lamprey, which move up from the adjacent Pembrokeshire Marine SAC.

5.1.2.1 Lamprey

General information on lamprey in the connecting Pembrokeshire Marine SAC (Section 0) is also applicable to the phases present in the Cleddau Rivers SAC as these are the same individuals.

Sea lamprey are surveyed in the Cleddau Rivers (at 18 sites in the East and West Cleddau, respectively) as part of NRW's reporting cycles for the SAC. On both survey events sea lamprey were not found. NRW state that the target flow conditions are not met and also pollution events and barriers such as the weir at Haverfordwest may also contribute to the lack of observations of this species (NRW, 2022).

In terms of river lamprey, during the second reporting cycle this species was reported as unfavourable – recovering as met its performance indicators for its population attributes, relating to age and size structure of the ammocoete population, distribution of ammocoetes within the catchment and ammocoete density (NRW, 2022).

5.1.3 Skomer, Skokholm and the Seas off Pembrokeshire SPA (UK9014051)

The islands of Skomer and Skokholm support the largest concentration of breeding seabirds in England and Wales. They are designated for their breeding colony of Manx shearwater (150,000 pairs) which is the largest colony in the world (the world population is considered to be 316,000 pairs), and have one of the largest colonies of lesser black-backed gull in Britain (20,300 pairs which represents 16.4% of the breeding biogeographic region population which is spread over 10,000 apparently occupied sites,). They are also designated for other seabird species , such as storm petrel (3,500 pairs, representing 4.1% of the GB population), Atlantic puffin (9,500 pairs, 1.1% of world breeding population) and supporting a breeding seabird assemblage of over 394,000 birds. This assemblage includes other species such as black-legged kittiwake, razorbill and guillemot (Natura 2000, 2017).

5.1.3.1 Manx shearwater

Manx shearwater nest on the remote islands of the SPA in burrows as they are relatively immobile on land which makes them vulnerable to predation. In terms of prey items and foraging distance, Manx shearwater feed on small fish such as clupeids (sometimes diving up to 55m) and tend to travel further during incubation than chick-rearing. Incubating birds from Skomer have been found to undertake trips of 8 (7–11) days

duration, covering total distances of 1,517 (925–2,117) km and reaching a maximum distance from the colony of 254 (176–295) km (Scottish Government, 2022) to exploit food resources.

5.1.3.2 Puffin

Puffin breed in burrows and normally forage around 25km from the colony. In Skomer, adults and chicks feed on sandeel, haddock *Melanogrammus aeglefinus* and sprat, with sandeel present in 94% of prey items sampled (Fayet, *et al.*, 2021).

5.1.3.3 Storm petrel

Storm petrel nest on rat-free remote islands. They forage using shallow dive techniques but like the Manx shearwater undertake long foraging journeys of over 300km (Scottish Government, 2022) to exploit food resources. They feed both offshore and in the intertidal coastal zone on zooplankton and ichthyoplankton and larger items such as young sprat, herring, gadoids and crustaceans.

5.1.3.4 Lesser black-backed gull

According to JNCC (2021) numbers of chicks fledged per pair of lesser black-backed gull on Skomer Island fluctuates widely but has often been low, averaging 0.36 chicks fledged per pair between 1986 and 2019. This has been linked with a reduction in food availability and quality during the chick rearing period, cited as being due to the reduction of discards from fisheries and chicks being fed on earthworms.

5.2 Conservation Objectives

European and national legislation places a collective obligation to maintain habits and species within the Natura 2000 network at favourable conservation condition. Favourable conservation condition is defined through the use of Conservation Objectives; a set of specific aims and target conditions. Site specific conservation objectives for particular habitats and species are listed in Table 5-1Table 5-1. Conservation objectives for Screened in sites..

Table 5-1. Conservation objectives for Screened in sites.

European Site Name and Code	Qualifying Interests	Conservation objectives
Pembrokeshire Marine / Sir Benfro Forol SAC (UK0013116)	Estuaries Mudflats and sandflats River lamprey Sea lamprey	To achieve favourable conservation status all the following, subject to natural processes, need to be fulfilled and maintained in the long-term. If these objectives are not met restoration measures will be needed to achieve favourable conservation status. Habitat features: Range: The overall distribution and extent of the habitat features within the site, and each of their main component parts is stable or increasing. For the inlets and bays feature these include; • The embayment of St. Brides Bay • The ria of Milford Haven • Peripheral embayments and inlets Structure and function: The physical biological and chemical structure and functions necessary for the long-term maintenance and quality of the habitat are not degraded. Important elements include; • geology, • sedimentology, • geomorphology, • hydrography and meteorology, • water and sediment chemistry, • biological interactions. Species features:

European Site Name and Code	Qualifying Interests	Conservation objectives
		Populations: The population is maintaining itself on a long-term basis as a viable component of its natural habitat. Important elements include: • population size • structure, production • condition of the species within the site. Range: The species population within the site is such that the natural range of the population is not being reduced or likely to be reduced for the foreseeable future. Supporting habitats and species: The presence, abundance, condition and diversity of habitats and species required to support this species is such that the distribution, abundance and populations dynamics of the species within the site and population beyond the site is stable or increasing. Important considerations include; • Distribution • Extent • structure • function and quality of habitat • prey availability and quality. As part of this objective, it should be noted that; • The abundance of prey species subject to existing commercial fisheries needs to be equal to or greater than that required to achieve maximum sustainable yield and secure in the long term. • The management and control of activities or operations likely to adversely affect the species feature is appropriate for maintaining it in favourable condition and is secure in the long term. • Contamination of potential prey species should be below concentrations potentially harmful to their physiological health. Disturbance by human activity is below levels that suppress reproductive success, physiological health or long-term behaviour
Affonydd Cleddau/ Cleddau Rivers SAC (UK0030074)	Sea lamprey River lamprey	• The conservation objective for the watercourse is met. • The population of the feature in the SAC must be stable or increasing over the long term. • The natural range of the feature in the SAC is neither being reduced nor is likely to be reduced for the foreseeable future. The natural range is taken to mean those reaches where predominantly suitable habitat for each life stage exists over the long term. Suitable habitat is defined in terms of near-natural hydrological and geomorphological processes and forms e.g. suitable flows to allow upstream migration, depth of water and substrate type at spawning sites, and ecosystem structure and functions e.g. food supply (as described in the Site outline section). Suitable habitat need not be present throughout the SAC but where present must be secured for the foreseeable future. • Passage of the feature through the SAC is not to be hindered by artificial barriers such as weirs (NRW 2022). • The characteristic channel morphology provides the diversity of water depths, current velocities and substrate types necessary to fulfil the habitat requirements of the features. The close proximity of different habitats facilitates movement of fish to new preferred habitats with age.
Skomer, Skokholm and the Seas off Pembrokeshire	European storm petrel Manx shearwater Atlantic puffin Lesser black-backed gull	Maintain or enhance • The size of the population should be stable or increasing, allowing for natural variability, and sustainable in the long term. • The distribution of the population should be being maintained, or

European Site Name and Code	Qualifying Interests	Conservation objectives
SPA (UK9014051)	Seabird assemblage of international importance	where appropriate increasing. • There should be sufficient habitat, of sufficient quality, to support the population in the long term. • Factors affecting the population or its habitat should be under appropriate control.

5.3 Potential Impacts

Qualifying features may be directly or indirectly affected by the abstraction of water from Pennar Gut through the loss of fish from the marine environment. Fish entrapment (the impingement of adult fish directly onto screens, and the entrainment of larval and juvenile fish through the screens) is a known pressure from cooling water drawn from coastal and freshwater environments. In the context of cooling water system effects, the following definitions apply:

- **Entrapment**: the entry into the Cooling Water (CW) system of aquatic organisms caused by the ingress of water. The term implies that the organism is unable to resist capture owing either to poor or no swimming ability, or to its failure to interpret the water intake as a hazard.
- **Impingement**: the retention of entrapped organisms on CW intake screens that are employed to prevent debris entering the CW heat exchangers. To become impinged, organisms must be large enough to be retained by the screen meshes.
- **Entrainment**: the passage of entrapped organisms that penetrate the CW screens and are returned to the estuary via the pumps, heat exchangers and other components of the CW circuit (typically zooplankton, including ichthyoplankton, and phytoplankton). Note: the size breakpoint between impingement and entrainment depends on the size of mesh openings selected, the orientation of organisms to the CW screens, and the extent to which the screen performance is affected by debris present.
- **Entrapment Pressure**: the mortality of individuals life stages or ecological guilds due to entrapment (entrainment and/or impingement), expressed as total abundance or biomass.
- **Entrapment Significance**: entrapment pressure scaled to the conservational value of species, communities and the ecosystem, or expressed as number or biomass entrapped relative to population sizes.

The potential impacts of the Pembroke Abstraction Licence Renewal for which LSE have been identified for European sites are outlined below, and assessment of the entrapment pressure and significance on qualifying features is provided in Section 7.

5.3.1 Direct Mortality through Entrapment

The loss of fish through entrapment at the intake face has the potential to remove fish from Pennar Gut which could go on to form part of the typical fish community of the Estuaries QI (Pembrokeshire Marine SAC) and result in direct mortality of migratory species that reside, and move between, the Pembrokeshire Marine SAC and Cleddau Rivers SAC. The importance of this loss, in terms of integrity to these two European sites (and supporting qualifying features) has been assessed in Sections 7.2.1 and 7.2.2.

5.3.2 Loss of Feeding Resource

The abstraction of water for cooling at Pembroke is known to contain larval and juvenile fish that are unable to avoid being drawn into the intake forebay. The loss of fish through entrapment at the intake face has the

potential to remove fish from Pennar Gut which could go on to form part of the feeding resource for marine bird QI of the Skomer, Skokholm and Seas off Pembrokeshire SPA. The importance of this loss, in terms of integrity to the relevant European sites (and supporting qualifying features) has been assessed in Section 7.3.

It should be noted that the current operation of the Pembroke Abstraction Licence forms part of the existing baseline upon which this assessment is based. Operation of Pembroke Abstraction licence has been continuous (with the exception of routine maintenance outages) since licenced.

5.3.3 Habitat Change

The abstraction of cooling water requires an increase in the rate of the volume of water flowing through Pennar Gut and therefore localised hydrological changes in the vicinity of the intake infrastructure occur. These changes have the potential, e.g., through scour of sediments, to modify the Mudflats and sandflats not covered by seawater at low tide habitat (and hence the Estuaries feature) of the Pembrokeshire Marine SAC. The mudflats and sandflats feature is distributed extensively around Pennar Gut (and present along the southern boundary of the abstraction intake channel as mapped by DataMapWales (2023)) and Milford Haven. The effects of any modification to mudflat habitat, in terms of integrity to the European site (and supporting qualifying features), has been assessed in Section 7.4.

5.4 Baseline (fish)

A large body of evidence exists on the baseline fisheries communities of Milford Haven which is consulted on regularly with NRW. It should be noted that a significant proportion of this baseline data has been collected by RWE to assess the potential impacts from abstraction and discharge of cooling water. Principal data sources are listed in Table 5-2. This baseline data captures the wider operational effects of the station as the fish populations are also subject to effects of operational discharge. These effects (i.e. increased temperature, biocide dosing) are assessed as part of the monitoring for environmental permit compliance and to date, no ecologically significant effects have been identified that are attributable to station operations.

In addition RWE have completed a climate change projection report (RWE, 2023) to satisfy a condition in the Pembroke permit which requires the station to "*review their hydrodynamic modelling in the light of the identified best available climate change projections by 2017 and every six years thereafter unless otherwise agreed". The station is also required to "assess whether any changes are necessary to the manner in which the activities are carried out or to the permit*". The assessment demonstrated that there are only relatively small changes in the size of the mixing zones for simulations of continuous long term operation at the maximum flow and temperature rise with climate change included.

Table 5-2 Data sources used in the baseline

Data source	Data	Dates
NRW Transitional fish monitoring	Otter trawl, seine net, beam trawl, fyke net. Electric fishing	2007 and 2010 and then in 2012, 2014 – 2016 and 2019 (otter trawl) 2005 and 2019 (seine net) 2005, 2011, 2013, 2014, 2015 and 2019 (fyke and beam trawl); 2016 (fyke only) 2014 (electric fishing)
Pembroke Power Station (onsite)	Impingement and entrainment data	40 surveys annually (2012- ongoing)
Pembroke Power Station (offsite)	Subtidal and intertidal fisheries Ichthyoplankton tows	Quarterly surveys (2009 – ongoing) 6 samples (Apr-Jun) (2009 -ongoing)

These data sources have been interrogated to understand the fish communities present within Milford Haven and vulnerable to entrapment.

5.4.1 Typical fish community supporting the Estuaries qualifying feature

5.4.1.1 General fish

The Pembrokeshire Marine SAC supports a diverse fish assemblage and the fish component of the NRW TraC monitoring of Milford Haven Inner was classified as Good in Cycle 2. Milford Haven is also an important fish nursery habitat, especially for the European seabass and a local race of herring, the latter spawning in spring in the waters of the Daugleddau (the confluence of the East and West Cleddau). Two other areas of the Haven are also designated as seabass nursery areas – one of which is adjacent to the power station site. The Haven also sees an annual spawning run of salmon and sea trout into the freshwater catchments. Approximately 80 species of fish have been recorded from Pennar Gut since 2012, as part of entrapment survey monitoring.

Jacobs have been monitoring fish populations in the estuary as part of the Pembroke marine monitoring programme. A detailed review of the data can be found in the annual monitoring reports (Jacobs 2023b,c, 2020a, 2020b) but a summary is provided here.

The ichthyoplankton community composition has remained similar throughout the monitoring period with gobies dominating the abundance and clupeids and blennies also contributing significantly to overall abundance. Fish larval densities and diversity in Milford Haven have increased since the minimum recorded in 2012. This observed minimum could be linked to mild weather triggering early spawning which was not captured in the monitoring programme. Significant differences were found between all years and can be attributed predominantly to fluctuations in the abundance of specific species, such as gobies. This is indicative of the high inter-annual variability in ichthyoplankton abundance.

Abundance of juvenile and adult fish communities in Milford Haven has exhibited a consistent pattern of peaks in the intertidal during summer and in the subtidal during autumn/winter throughout the monitoring period. Statistical analysis highlighted the highly dynamic nature of fish communities in Milford Haven with differences in community composition and abundance from year to year being attributed to fluctuations in the abundances of taxa commonly found in the estuary, both abundant and less numerous ones.

Impingement monitoring provided a comprehensive picture of a subset of the fish community, and in particular those species using Pennar Gut and Pembroke River that are vulnerable to impingement. Impingement catches generally reflected fish abundances in the Haven with the same dominant species recorded; gobies, sand smelt, sprat and other clupeids.

Further analysis by Jacobs (2023) of the data from the intertidal and subtidal fish surveys, impingement, ichthyoplankton and entrainment surveys has enabled monitoring of the presence of regularly occurring species for their persistence, i.e. to detect potential changes in the fish communities. Regularly occurring "core taxa" show persistence from year to year and include both the most abundant species and some less abundant species that are consistently recorded from the monitoring programme.

Sixteen fish species have been recorded in all 16 years since monitoring began in 2006 and 37 taxa have been recorded every year since 2009 which is the starting point for long-term quantitative data analysis. Forty-six taxa have been recorded every year since commissioning of Pembroke Power Station began in 2012 (Appendix A). It should be noted that the majority of the taxa noted from the earlier surveys (2006 to 2008) remain present in the surveys carried out between 2009 and 2021; therefore, there is no evidence of a change in the core species assemblage since operation of the station. Some species, such as sea lamprey, long-snouted seahorse, 22oldsinny wrasse, Baillon's wrasse and lumpsucker were not recorded until impingement surveys commenced in 2012. These species were most likely not recorded because they were less susceptible to capture through other forms of surveying as opposed to being absent from the Haven.

5.4.1.2 NRW Data

NRW carries out annual fish monitoring as part of the WFD transitional water bodies monitoring programme. The water body surveyed is the Milford Haven "Inner" transitional, and the majority of sites are located upstream of the power station. Fish are not a quality element for 'coastal' water bodies such as Milford Haven Outer. However, there are three sites from this programme which are in proximity to the subtidal and intertidal fish sites which are sampled quarterly as part of the Pembroke Power Station environmental

monitoring programme. These (unpublished) data have been analysed in order to give context to the results presented in this report.

NRW carry out otter trawl surveys (single 30-minute run) at 'Pennar Flats' site (NGR SM 94326 03207 (provided by NRW)) which is located at Pennar mouth and lies in close proximity to Pembroke power station. Otter trawl surveys were carried out annually between 2007 and 2010 and then in 2012, 2014 – 2016 and 2019. A total of 30 discrete taxa were recorded from these surveys, all of which have been recorded in the power station subtidal fish monitoring programme with the exception of ten-spined stickleback. The presence of ten spined stickleback is likely the result of flushing from freshwater systems as this species will tolerate mildly brackish water but does not inhabit stronger salinity waters.

Seine net surveys carried out by NRW between 2005 and 2019 recorded a total of 28 taxa. Of these, all except two species, roach (*Rutilus rutilus*) and rudd (*Scardinius erythrophthalmus*), have also been recorded in the power station intertidal fish surveys. Both of these species not recorded in the station surveys were found at the top of the Eastern Cleddau and are freshwater/brackish species. Roach and rudd are likely to be present in the estuary only as a result of flushing from freshwater systems under high fluvial flow and therefore should not be considered as part of the natural estuarine fish fauna surrounding the power station.

The NRW data Indicate similar pat"erns'in abundance of taxa in intertidal samples to the power station monitoring. The dominant taxa recorded from the power station intertidal monitoring programme are sand smelt, sprat, sand goby and grey mullet. The NRW intertidal fish surveys also recorded these and other taxa (e.g. flounder, bass, plaice) commonly reported from the power station fish monitoring. However, the abundance and diversity in the NRW data are comparatively lower which is expected as the NRW sampling programme has a lower temporal and spatial resolution due to the different monitoring objectives.

NRW have also carried out fyke net and beam trawl surveys in 2005, 2011, 2013, 2014, 2015 and 2019 (and in 2016 for fyke net surveys) from which 16 and 14 species were recorded, respectively, all of which have been recorded previously in intertidal/ subtidal and/or impingement surveys for the power station.

Electric fishing data were collected by NRW from Pembroke River in 2014 and show the presence of brown trout, Atlantic salmon and European eel. These are species of conservation interest and have also been recorded from entrapment and other fish surveys reported here.

5.4.2 Lamprey Species

5.4.2.1 River lamprey

Entrapment of river lamprey at Pembroke Power station is rare. During the period of operation (2012 to 2022), no river lamprey have been reported from over 480 entrapment surveys at RWE Pembroke. The numbers of individuals within the SAC at any time, and their distributions and proportions of wider populations, are likely to be dynamic and highly seasonal but are unknown (NRW, 2018). As stated in Section 5.1.1 river lamprey spend 1-2 years residing within estuaries, where they feed on herring (*Clupea harengus*), sprat (*Sprattus sprattus*) and flounder (*Platichthys flesus*). As such river lamprey are assumed to be present in Milford Haven around the year.

5.4.2.2 Sea lamprey

Sea Lamprey have been recorded sporadically from impingement surveys at Pembroke over the period of operation (2012 to 2022). Annual catches have varied from 0 to 0.103 individuals per 10^6 m^3 of water abstracted. The very low rate of occurrence within the entrapment surveys is therefore likely to represent an insignificant catch, particularly as the surveys timings are such that they are representative of changes in catch owing to seasonal and tidal differences.

5.4.3 Feeding Resource

The QI of the Skomer, Skokholm and Seas off Pembrokeshire SPA target a range of food sources with some being more focused than others. Species such as the lesser black-backed gull are opportunistic hunters / scavengers, while species such as the Atlantic puffin target species such as sand eel, herring and hake.

Dominant food sources include clupeids (herring, sprat, pilchard), sand eel and gadoids (cod family) therefore more baseline detail is provided for these groups below.

5.4.3.1 Clupeids

In terms of juvenile and adult life stages of prey species that are targeted by birds such as herring, impingement of this species has generally shown a pattern of decline since 2015, when numbers peaked. Impingement catches of herring in 2019 represented the lowest annual average recorded to date (representing a 94% reduction from 2012) with 2020 and 2021 representing the second and third lowest annual averages. This decline was predominantly owing to a decrease in the impingement of adolescent and adult herring in 2017 – 2021 (impingement of juvenile herring remaining consistent with that observed in 2016). However, the annual average abundance of herring larvae in the Haven and entrained at the power station did not indicate an obvious decline in recruitment; in 2019 the abundance of herring larvae in Milford Haven was the highest since 2007. This suggests adult herring are using the Milford Haven to spawn, despite being under-represented in impingement surveys and in the Haven.

Comparison to temporal patterns of herring abundance within the wider Celtic Sea shows that the spawning stock biomass and recruitment of herring have been declining since around 2000 and are currently at the lowest level in the time series. Fishing mortality has reduced since 2016 when catches have been limited to scientific monitoring, but recovery of the stock is hampered by the very low recruitment (ICES, 2021). Assessment of the spawning herring stock in the Irish Sea showed stable spawning stock biomass had increased in 2020 to the highest recorded levels in the time-series with large incoming year classes in most recent years (ICES, 2021). The assessment of herring stock in the Celtic Sea could in some part explain the decline in abundance seen in the impingement since 2012 and to a lesser extent, that in the Haven.

It is likely that many factors are responsible for temporal fluctuations in herring abundance both within Milford Haven and the wider Celtic Sea. Natural and anthropogenic pressures operating at different scales will likely have differing effects depending on whether herring abundance is being examined at the population level or stock level. Furthermore, effects could interact synergistically or antagonistically on fish populations. For example, despite declines in herring stock abundance, commercial fishing in the Celtic Sea continued until 2016 and could have influenced, in combination with more localised pressures, the number of herring returning to Milford Haven to spawn.

Mean abundance of sprat in subtidal fish surveys demonstrated increasingly stronger peaks in summer during 2013 to 2015 owing to single isolated large hauls of sprat in each of these surveys. Increased abundances of sprat in most summers between 2012 and 2020 have also been recorded from intertidal surveys. In contrast, low abundances of sprat were recorded from subtidal surveys in 2016 – 2021, as well as intertidal surveys in 2016 and 2018. Despite this, sprat was overall the second most abundant species recorded in the subtidal and the intertidal surveys over the 11-year monitoring programme and the most abundant species recorded in impingement surveys. The high numbers of juvenile sprat in impingement catches could also be attributed to early shoaling behaviour of this species, similar to herring which begin shoaling at 35–- 40 mm and exhibit a well-developed schooling behaviour by 50–- 55 mm (Gallego and Heath, 1994).

There was a higher abundance of sprat recorded from impingement surveys in autumn and winter, which is believed to be related to several factors. For example, to the increased movement of this species within, as well as in and out of the estuary, coupled with the increased susceptibility to impingement during these seasons owing to low temperature effects on swimming ability.

The autumn and winter peaks also reflect the seasonal abundance pattern of sprat within the Irish and Celtic Seas where numbers are found to peak November – December and again in spring during spawning (ICES, 2017). This continual movement in and out of the estuary is likely to explain, in part, why considerable variations in the abundance of sprat impinged are observed on the station at the daily temporal scale between October and February. Sprat is also a multiple batch spawner, with females spawning up to 10 times in a single season (George, 1987). The staggered arrival of juveniles to inshore areas is, therefore, likely to further influence the abundance and distribution of sprat within the Haven which in turn influences the susceptibility of this species to impingement.

5.4.3.2 Sandeel

Sandeel species have been entrapped at the power station in all years but in low abundances (e.g. maximum impingement rate of 0.27 individuals per 10^6 m^3 annual mean) compared to other more abundant species such as sprat (which are typically impinged in the order of 100 per 10^6 m^3 water). It is therefore not considered to be a significant proportion of the impingement catch. Similarly, species of sandeel were not amongst the most abundant taxa in the entrainment catches (Jacobs, 2021).

5.4.3.3 Gadoids

Gadoids, particularly poor cod and whiting were more abundant in the subtidal area in autumn and winter, with poor cod being the most abundant. Poor cod and whiting utilise the estuary in different ways. Poor cod is a marine adventitious species that spawns in late winter and early spring at depths of 50 – 100 m, before moving into the estuary in autumn to feed on abundant benthic crustaceans. Whiting, on the other hand, is a piscivorous species using the estuary as nursery grounds. Only a single poor cod (in summer 2020) has been recorded from the intertidal surveys as this species prefers deeper waters. However, numerous adolescent and adult poor cod (particularly 1+ and 2+ groups) have been recorded between 2009 and 2021 in the subtidal surveys, despite few large adults (4+ and >4+ groups) recorded in 2017 – 2021 (0 in 2020 and 1 in 2021) compared to previous years. Catches of poor cod in the subtidal were broadly similar to previous years in 2020 but decreased to the lowest levels recorded in 2021. Impingement of this species was higher in winter and autumn and reflects the abundance and size classes present in the estuary. Impingement of poor cod decreased in 2019 and decreased further in 2020 (the lowest levels recorded) and 2021 (second lowest levels recorded).

6. Incorporated Mitigation Measures

Mitigation measures (intended to avoid or reduce the harmful effects of the Abstraction Licence on a European Site) are usually separately identified when:

- They will be specifically added as an extra measure;
- Their sole purpose would be to avoid or reduce harmful effects on a European Site;
- The proposal could lawfully and practically be implemented without such mitigation measures if the proposal would not have any potential adverse effects on a European Site; and
- The mitigation measures could be removed if their effects were no longer required without changing the aims, goals, objectives, or other policies or proposals (i.e. the essential features and characteristics) of the Project.

The current abstraction licence has been in place since 2009 and have incorporated design measures as an integral part of the abstraction infrastructure, as described above (Section 3.3.2) and below (Table 6-1). There have been no significant effects of abstraction seen in the monitoring programme to date, therefore there is no proposed bespoke mitigation for the assessments. The current abstraction licence has been in place since 2009 and therefore the level of confidence in the effectiveness of design measures is high.

Table 6-1. Design Measures

Measures	Evidence of Success
Operation	
Use of acoustic fish deterrents Strobe lighting at the intake structure	Installed measures meet best practice (Turnpenny and O'Keeffe, 2005) The successfulness of fish deterrents is species specific, depending on the design of the system and between hearing and non-hearing fish specialists. AFD deflection may be less than 30% in flatfish and other epibenthic species, and >90% in hearing specialists. Typical fish deflections from AFD is 50-80%. Specific trials on the efficacy of the system at Pembroke have been agreed to not be possible owing to constraints with respect to scientific rigor and permits. Ongoing monitoring is undertaken to monitor the continued effect of installed measures and ensure that best practice is being met.
Coarse and fine screening Coarse screens with 50mm bar spacing Rotating drum screen with 6mm mesh	Best practice (Turnpenny and O'Keeffe, 2005)
Fish recovery/return Backwashed fish return system	The fish recovery and return system is considered best practice design (Turnpenny and O'Keeffe, 2005). It includes features such as: fish friendly buckets and screens, 6mm mesh sizes, dual pressure backwash system for fish and debris, enclosed fish lines, dedicated FRR lines and continuous wash water. The successfulness of FRR differs between species (0% for clupeids up to 80% for flatfish and salmonids). Monitoring of the fish return between 2014 and 2021 indicates that the FRR is effective at returning between 29-72% of total fish catch (and 24-78% of the total fish biomass) annually to Pennar Gut. Since operation of the power station (under the existing abstraction licence) survivability of species through the fish return has been studied (through desk assessment and practical survivability studies at Pembroke). Jacobs (2023) identifies 94% and 84% survivability of flatfish and gobies respectively, 80% survivability for dogfish, European eel, rays and conger eel. Gadoids, mullet stickleback, sea lamprey, breaks, pipefish and gurnards have a survivability of 50-66%. Bass and sand smelt have a survivability of 30-38% and all other species have a survivability of 0% (including clupeids, sand eel, salmonids,

Measures	Evidence of Success
	wrasse and mackerel.

7. Potential Adverse Effects on Site Integrity (Alone)

7.1 Introduction

There is a requirement to determine whether the proposed Abstraction Licence Renewal, either individually or in-combination with other plans or projects, could result in adverse effects on the integrity of the screened in European Site(s), with respect to the Conservation Objectives of the QI habitats and species. This section considers the effects of the Abstraction Licence Renewal alone. As the Abstraction Licence Renewal is a like for like renewal of the existing licence, it is possible to determine with high certainty the potential for adverse effects owing to the monitoring and current status of the European sites.

7.2 Loss of Aquatic Fauna from Impingement and Entrainment

7.2.1 Direct Mortality of Typical Fish Community

In light of evidence provided by the environmental monitoring programme carried out in the wider Haven, there is no evidence to suggest that entrapment at Pembroke Power Station is applying a detectable or significant ecological pressure to fish populations at the species and community level. The differences observed in fish abundance and community structure over the monitoring period, remain in line with expected natural variations and are of a magnitude and nature which is not significant from an ecological and conservational point of view. The observed variability in fish community data is the result of high mobility, seasonal behaviour and complex life histories, and would be expected to display natural variation between seasons and years. The abstraction of cooling water from Pennar Gut neither reduces the natural range of typical estuarine species nor adversely affects supporting habitats. Water abstraction has no effect on the distribution, abundance and population dynamics of the fish community as a supporting element of the Estuaries qualifying interest as data has shown that the communities are stable within natural variation. This trend has been observed and reported during the duration of the existing abstraction licence therefore there is no adverse effect on site integrity. The evidence for this is provided below.

Analysis of the full fish dataset from the marine monitoring programme has highlighted the highly dynamic nature of fish communities in Milford Haven with differences in community composition and abundance from year to year being shown to be attributed to fluctuations in the abundances of taxa commonly found in the estuary, both abundant but also less numerous ones (Jacobs 2023c). There are evident spikes observed in the abundance of certain species, however, there is an underlying core of fish taxa that show persistence (Appendix A) from year to year and, whilst taxa exhibit short-term fluctuations as would be expected in a dynamic environment such as Milford Haven, maintains a relative long-term stability in terms of species abundance and composition.

It is noteworthy that the species changing most dramatically over the years are opportunistic, fast growing species like sprat and sand smelt. The high summertime catches of sprat and also of sand smelt recorded in some years, likely reflect an increase in their respective stocks outside the Haven. Abundances of sprat are also likely linked to winter and summer temperatures, low winter temperatures likely causing the low recruitment of ichthyoplankton and subsequent low juvenile and adolescent abundances recorded in 2018.

The majority of other inter-annual differences in seasonal catches were largely due to fluctuations in the abundance of the most dominant taxa both in the intertidal (gobies, sand smelt, herring and grey mullet species) and the subtidal (e.g. herring, lesser-spotted dogfish, cod, *Pomatoschistus* spp. and plaice). Some less abundant species such as fifteen-spined stickleback, pollack, pilchard, plaice and two-spotted clingfish in the intertidal and starry smoothound, flounder, grey mullet, dragonets and tub gurnard in the subtidal, also contributed to differences between some years. The fluctuations in the abundance of the dominant taxa were small and in line with expected natural fluctuations of stock populations. Changes in the abundance of these taxa reflect their life histories including migration in and out of the estuary, and also timing of spawning and recruitment success both within and outside the Haven.

It is acknowledged that species populations, including fish communities, within the Haven vary in time and space, partly reflecting the variable habitats and dynamic environment of the estuary; stochastic events and

the great variation in survival and recruitment of species also plays a major role (NRW, 2017). As such, 'boom and bust' species such as sprat and sand smelt have demonstrated dramatic increases and decreases during the monitoring programme as a result of natural variability in environmental factors, spawning and recruitment success and other factors relating to their population dynamics. Equally, species that are infrequently recorded may disappear altogether for a period of time, whilst new ones might arrive in the Haven particularly as species ranges extend northwards as a result of climate change. Importantly, it is expected to see short-term changes to the fish communities within Milford Haven, but it is the relative long-term stability (e.g. cyclical patterns) and persistence of species populations and functional guilds that should inform any assessment of impacts of any pressure of which power station operation is one.

Impingement monitoring provides a comprehensive picture of a subset of the fish community, and in particular those species using Pennar Gut and Pembroke River that are vulnerable to impingement. The fish impinged in the highest abundances were the same dominant species recorded from the Haven; sprat and other clupeids, sand smelt and gobies. Impingement generally reflected fish abundances in the Haven, though a decoupling was observed in 2017 – 2019 with low overall numbers of fish impinged compared to previous years. Particularly the impingement of sprat and sand smelt did not reflect the abundance peaks observed in the Haven in these years; this is perhaps due to the patchy distribution of these species in the estuary as a result of their shoaling nature. Additionally, continual reviews of performance of the of the AFD system since 2017 may have in part resulted in lower overall numbers of fish impinged. Seasonal patterns in ecological and feeding guilds within the intertidal and subtidal fish communities reflected the fluctuations in the abundance of dominant species with occasional isolated high catches of sprat and sand smelt. Marine seasonal species such as sprat were impinged in the highest abundance; however, their vulnerability was restricted mainly to autumn and winter and predominantly to juvenile life stages. In contrast, estuarine residents such as gobies, were impinged at lower numbers but were vulnerable to impingement year-round and at all life stages.

Patterns in diversity indices of the intertidal fish community were overall similar across years; with the exception of the overwhelming dominance of sand smelt in summer 2016 making the species diversity of that season significantly lower than previous years. Diversity of the subtidal fish community exhibited high variability from year to year, reflecting the high variability in catches both in terms of abundance and species composition, most likely due to natural spatial and temporal variability owing to the high mobility of fish; there was no pattern to suggest that diversity had decreased or increased overall since the power station became operational. The overall diversity of impingement catches and main taxa impinged were similar across years indicating a relatively stable fish assemblage impinged from year to year.

Entrapment monitoring undertaken as part of the current environmental permit conditions indicates that the seasonal fluctuations and patterns observed in the abundance and species composition of fish communities have not changed since the power station became operational. The population structure of the most common species has also remained the same since pre-commissioning. Detailed technical assessments to date have shown only small differences in the overall fish community structure within Milford Haven over the period of construction, commissioning and operation of the power station. These differences reflect the complex life histories of the most numerous species present in the study area both within and outside the Haven, rather than a shift in community structure or fish abundance. Isolated high catches of some common species have been recorded over the years; however, these species spawn outside the Haven and therefore are not solely affected by conditions within the estuary. A decreasing trend in annual subtidal fish catches was first observed in 2007, prior to station operations; as such it is considered that it is likely part of a longer-term trend or cyclical pattern and not associated with power station operation (Jacobs, 2023b).

The Abstraction Licence Renewal, on a like for like basis, will therefore not result in any Adverse Effect on Site Integrity when considering the Estuarine conservation objectives.

7.2.2 Direct Mortality (River and Sea lamprey)

As outlined in 5.4.2 above, the number of lamprey impinged at Pembroke since operation began in 2012 is very low with only a single river lamprey and 25 sea lamprey recorded. No lamprey have been identified from within the wider monitoring programme, though this is likely a function of the survey methods used as the species are migratory and are only moving through the estuary. Sea lamprey are typically vulnerable to impingement during isolated periods of the year, as they are migrating between freshwater and marine habitats. Based on length-frequency analysis, it is likely that the majority of sea lamprey impinged at

Pembroke Power Station represented recently metamorphosed individuals migrating downstream to feed in the marine environment (National Rivers Authority, 1992; Maitland, 2003). The only exception was a single sea lamprey which was recorded in April 2013 and measured 800 mm standard length; this individual is likely to have been a sexually mature adult migrating upstream to spawn.

The mitigation measures in place at Pembroke are intended to reduce the overall level of impingement using sound deterrent through the AFD and light through the strobe. Both of these mitigation measures were not principally designed for the primitive lamprey species, however the fish recovery and return system in place was designed to support the return of species in a viable condition. Bespoke survival studies were undertaken at Pembroke to determine the 24-hour survivability of entrapped fish. Observations on these studies showed lamprey to have a 50% survival rate following impingement indicating that not all impinged lamprey will be lost from populations (Jacobs 2023b).

The 2018 condition assessment for the Pembrokeshire Marine SAC (NRW 2018) shows both river lamprey and sea lamprey as being in unfavourable conservation status, citing water quality issues as the driving factor for the classification. Pembroke abstraction is not affecting the water quality status of the estuary, nor is it affecting the population status of lamprey within the SAC (evidenced by the infrequent capture of lamprey, and the potential survival of impinged individuals).

The features within the Cleddau Rivers SAC are shown to be in favourable status and the Pembroke abstraction does not create a barrier that would reduce the natural range of the species, nor does it present a barrier to mitigation.

The abstraction of cooling water from Pennar Gut neither reduces the natural range of either species nor adversely affects supporting habitats and species. Water abstraction has no effect on the structure or the distribution, extent, structure, or function of estuarine lamprey habitats.

The Abstraction Licence Renewal, on a like for like basis, will therefore not result in any Adverse Effect on Site Integrity when considering lamprey species conservation objectives.

7.3 Loss of Food Resource (piscivorous birds)

7.3.1.1 Foraging Range of QIs

Table 3-1Table 7-1 indicates that the foraging range of breeding birds that are QI of the Skomer, Skokholm and the Sea off Pembrokeshire SPA encompass Milford Haven. With the large foraging area available offshore and intertidally off the Pembrokeshire coast, it is considered unlikely that the prey resource within the industrialised waterway of Milford Haven would represent a significant contribution to the overall feeding resource of piscivorous bird species. Considering the foraging ranges of the bird features of the Skomer, Skokholm and the Sea off Pembrokeshire SPA it is considered highly unlikely that QIs will preferentially forage in the relatively disturbed estuary when they have significant fisheries resources available in undisturbed coastal and near shore areas.

Table 7-1. Foraging ranges of bird features of the Skomer, Skokholm and the Sea off Pembrokeshire SPA

QI	Max	Mean max	Mean
European storm petrel	>65km		
Manx shearwater	>330km	>330km	
Atlantic puffin	200km	105.4km +/- 46km	4km
Lesser black-backed gull	181km	141.0km +/-50.8km	71.9km +/-10.2km

7.3.1.2 Dietary Equivalents of Prey Loss through Entrapment.

Literature shows that the target prey species for the QIs are clupeids (sprat and herring), sandeel and gadoid species all of which are present in the water column in Pennar Gut and are vulnerable to entrapment. It should be noted that this applies to puffin, Manx shearwater and storm petrel. For lesser black-backed gull (opportunistic hunters/scavengers for small fish, marine invertebrates, food scraps, bird eggs) and seasonal bird assemblages, it is assumed that any fish species may be predated upon.

- Pembroke Power Station (entrapment surveys) – Of the 79 species recorded in the impingement surveys potentially predated upon by generalist seabirds, 17 were QI target species (clupeids, gadidae (gadiformes also included) and sand eel). Of the 41 species entrained, 7 were potential target species for the QI bird species.
- Pembroke Power Station (off site surveys) – of the 49 species/groups recorded in the intertidal surveys to date, 13 were QI target species. Of the 70 species./groups recorded in the subtidal surveys to date, six were QI target species.
- Subtidal areas are being used predominately by marine juveniles (e.g. sand smelt, bass, whiting and herring) from autumn through to spring. Marine adventitious taxa (e.g. lesser spotted dogfish and poor cod) are prevalent in subtidal areas during the spring and to a lesser extent, autumn and winter.
- The majority of fish (from an abundance point of view) are using the intertidal areas as marine juveniles, predominantly in spring and summer. This pattern was mainly driven by the presence and changing abundance of sand smelt.

To provide ecological context to impingement catches, the total extrapolated biomass of fish impinged each year at Pembroke Power Station can be compared to that which would support the dietary needs of a hypothetical 1000g seabird. It can be seen from Table 7-2 that the annual tonnages lost to entrapment at Pembroke represents the annual diet of only a few seabirds. These figures also represent the whole of fish biomass rather than target prey species, which would reduce effects further. The population numbers presented in Section 5.1.4 for the Skomer, Skokholm and the Seas off Pembrokeshire SPA are significant (in the thousands and tens of thousands) and the annual tonnage entrapped at Pembroke annually represents the annual diet of up to 16 birds which is inconsequentially small in the context of the SPA population numbers.

Table 7-2. Annual entrapment tonnage represented as 1000g seabird dietary equivalent.

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Annual impingement biomass (tonnes)	2.29	1.59	1.29	1.43	1.88	0.41	0.82	0.19	0.55	0.33
1000g seabird equivalent	16	11	9	10	13	3	6	1	4	2

When considered as a loss of food resource, impingement pressure is not considered to be having a significant effect on seabirds as their populations are likely to be reasonably resilient to small variations in food resource availability and also have a much larger foraging area than Milford Haven. Furthermore, all fish impinged are returned to Milford Haven, when possible, as biomass and would therefore be directly available as prey. As such this dietary equivalent analysis is considered to be highly precautionary.

The abstraction of cooling water from Pennar Gut neither impacts the SPA population, nor adversely affect the distribution of the population or supporting habitats. **The Abstraction Licence Renewal, on a like for like basis, will therefore not result in any Adverse Effect on Site Integrity when considering the Skomer, Skokholm and the Seas off Pembrokeshire SPA QIs conservation objectives.**

7.4 Modification of Marine Habitats through Abstraction

The abstraction of water in Pennar Gut draws water at all states of the tide, into the intake infrastructure of the power station. The existing abstraction licence calculated that low velocities would occur for 95% of the time, with the highest velocity practically likely to occur of 0.215ms^{-1} at chart datum, all of which fall below best practise approach velocities of 0.3ms^{-1}.

Pennar Gut, in front of the intake screens is subjected to regularly maintenance dredging, to maintain operational water depths for the abstraction of cooling water. As such, the sediment habitats within the ZoI of the screen are considered to be highly disturbed. Mudflat habitats are recorded immediately adjacent to the intake on both north and south shores of Pennar Gut. These habitats have been maintained, outwith the existing dredged channel through the operation of the existing abstraction licence. As such the overall distribution and extent of the habitat feature within the site is considered to be stable, The abstraction of

water at the intake will not adversely affect the physical biological and chemical structure of the mudflats. Low velocity abstraction, occurring over a very limited spatial range will not result in degradation of function of this habitat type. The effect of abstracted water velocities on mudflat and sandflat habitats, are considered ecologically inconsequential compared to the effect of maintenance dredging; which is subject to its own licence and assessment.

The Abstraction Licence Renewal, on a like for like basis, will therefore not result in any Adverse Effect on Site Integrity when considering the mudflats and sandflat habitats and Estuaries feature of the Pembrokeshire Marine SAC conservation objectives.

8. Summary of Stage 2 Appropriate Assessment

Table 8-1 lists the European Sites screened into assessment (see Table 3-4 for reference) and assesses the potential adverse effects on site integrity, following the adoption of mitigation listed in Section 6.

Table 8-1: Assessment of Adverse Effect on Site Integrity (AEoSI)

European site	Screened in QI	Pathway to effect	Mitigation	AEoSI (Alone)
Pembrokeshire Marine / Sir Benfro Forol SAC (UK0013116)	Estuaries Mudflats and sandflats not covered by seawater at low tide River lamprey Sea lamprey	Direct loss – general fish community Direct loss – changes in velocity Direct loss – mortality Direct loss – mortality	The current abstraction includes fish deterrent methods, including acoustic and visual fish deterrents, coarse and fine screening to reduce the impact from entrapment. A fish recovery system returns a proportion of all fish alive back to the Pennar Gut.	No AEoSI
Affonydd Cleddau/ Cleddau Rivers SAC (UK0030074)	River lamprey Sea lamprey	Direct loss – mortality	The current abstraction includes fish deterrent methods, including acoustic and visual fish deterrents, coarse and fine screening to reduce the impact from entrapment. A fish recovery system returns a proportion of all fish alive back to the Pennar Gut. The positioning of the intake is such that abstraction is undertaken beyond the migratory route of species moving between the open coastline and freshwater environments.	No AEoSI
Skomer, Skokholm and the Seas off Pembrokeshire SPA (UK9014051)	European storm petrel Manx shearwater Atlantic puffin Lesser black-backed Seabird assemblage of international importance	Indirect loss – feeding resource	The current abstraction includes fish deterrent methods, including acoustic and visual fish deterrents, coarse and fine screening to reduce the impact from entrapment. A fish recovery system returns a proportion of all fish alive back to the Pennar Gut.	No AEoSI

9. In-Combination Assessment

9.1 Inter-plan Effects: Assessment of in-combination effects between the Abstraction Licence Renewal and other Projects and Plans

Under Article 6(3) of the Habitats Directive, an assessment of potential in-combination effects between the proposed plan and other plans and / or projects should be considered. A search was carried out of public registers to obtain a list of developments with feasible spatial or temporal overlap with the proposed project (i.e. reasonably foreseeable future projects). The search area included the full marine foraging range of qualifying features. The search included the following organisations:

- Pembrokeshire County Council Public Access system;
- National Infrastructure Planning Portal; and
- NRW public register

The search of the Pembrokeshire Public Access system and the NRW public register found the following projects:

- Pembrokeshire Coastal Forum Marine licence for the META Phase 2 test sites, one of which (Warrior Way) is within the Milford Haven
- Milford Haven Port Authority Maintenance Dredge (2022 to 2032)
- Milford Haven Port Authority proposed works for Pembroke Dock Infrastructure.

Pembrokeshire Coastal Forum Meta Phase 2 test sites: This is an active marine licence extending through to December 2025 so there is temporal overlap with Abstraction Licence Renewal. The HRA for the Meta project concluded no adverse effects on the integrity of the Pembrokeshire Marine SAC either alone or in-combination.

Milford Haven Port Authority Maintenance Dredge (2022 to 2032): This is an active licence to cover disposal of maintenance dredge arisings. The HRA for the disposal assessed, in part, the effect of dredge arisings on the reef features of the Pembrokeshire Marine SAC and concluded no adverse effects alone or in-combination.

Pembroke Dock Infrastructure: This is an active marine licence to cover dredge operations, development and alteration to slipways and the infilling of Graving Dock and extends out to 2026. The HRA for the mega jetty project concluded no adverse effects on the integrity of the Pembrokeshire Marine SAC either alone or in-combination.

These projects are all located within or have the potential to effect the Pembrokeshire SAC and have some spatial and temporal overlap with the project. The projects themselves all concluded no adverse effects on the SAC features and there is no direct overlap in impact pathway with the abstraction licence. It is considered that the combined effects of the project would not lead to any potential LSEs on the SAC features considered in this assessment.

In addition to the above projects it is recognised that the ongoing operation of the Power Station under its existing Environmental permit (ENV/296/2008 EPR/DP3333TA) introduces water at increased temperatures into the Haven. As outlined in section 5.4 the baseline data on which this assessment has been made already inherently captures the effects of station operation, specifically temperature. The operation of the station is already regulated as part of the Environmental Permit, for which annual reports are prepared and discussed. None of these reports have indicated an effect on fish populations from increased temperature with the main community composition remaining stable.

In summary, none of the ongoing activities, plans and projects are anticipated to result in in-combination effects of a scale that would change the existing condition status of the interest features recognised within the European/Ramsar sites screened into this assessment. On this basis, the Project is considered to result in

no potential for an AEOI on any interest features of European/Ramsar sites in-combination with other plans, projects and activities.

10. Conclusion

This report provides information for NRW, as the relevant Competent Authority to undertake Stages 1 and 2 of a Habitats Regulations Assessment as required under Regulation 63 of the Conservation of Habitats and Species Regulations 2017 (as amended).

The Stage one (Screening) assessment has considered how the Abstraction Licence Renewal might affect six European sites in the vicinity and zone of influence of the Pembroke Power Station. This screening stage concluded that Likely Significant Effects could not be ruled out with respect to three European sites:

- Pembrokeshire Marine SAC.
- Cleddau Rivers SAC; and
- Skomer, Skokholm and the Seas off Pembrokeshire SPA.

The impact pathways screened into stage 2 (AA) covered the following pathways:

- Loss of juvenile and adult fish and invertebrates through impingement
- Loss of larval fish and invertebrates through entrainment
- Changes to water velocity in the vicinity of the intake

At Stage two AA, further information has been collated to examine the potential for changes in the baseline conditions as a result of the Abstraction Licence Renewal with reference to the conservation objectives for each site. The assessment has concluded that there is either no potential for an adverse effect on site integrity or any potential for the predicted effects to compromise their conservation objectives. This conclusion supports the conclusions of Pembroke Power Station's comprehensive environmental monitoring programme annually reported to NRW where no ecologically significant effects are found.

A review of other plans and projects that could contribute to effects has established that no significant adverse in-combination effects on site integrity with other plans and projects will occur.

In conclusion, it is considered that the continued abstraction as already authorised for Pembroke Power Station (alone or in combination with other plans or projects) will not have an adverse effect on the integrity of any European designated sites in view of those sites conservation objectives.

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Appendix A.

Table A-1. Persistence (number of years recorded) of each taxon from fish surveys within the Haven (Jacobs, 2021).

Species	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Persistence
Fifteen-spined stickleback	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	16
Ballan wrasse	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	16
Bass	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	16
Common dragonet	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	16
Dab	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	16
Greater pipefish	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	16
Grey gurnard	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	16
Herring	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	16
Lesser-spotted dogfish	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	16
Long-spined sea	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	16
Plaice	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	16
Pollack	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	16
Poor cod	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	16
Sand smelt	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	16
Sprat	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	16
Thornback ray	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	16
Flounder	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	15
Two-spotted goby	■		■	■	■	■	■	■	■	■	■	■	■	■	■	■	15
Five-bearded rockling		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	15
Bib		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	15
Black goby		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	15
Cod		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	15
Corkwing wrasse	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	15
Goby family		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	15
Nilsson's pipefish	■	■		■	■	■	■	■	■	■	■	■	■	■	■	■	15
Snake pipefish		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	15
Tub gurnard	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■	15
Whiting		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	15
Thick-lipped grey	■	■	■	■	■	■	■	■	■		■	■	■	■		■	14
Blenny family		■		■	■	■	■	■	■	■	■	■	■	■	■	■	14
Herring family		■		■	■	■	■	■	■	■	■	■	■	■	■	■	14
Shanny		■		■	■	■	■	■	■	■	■	■	■	■	■	■	14
Tompot blenny		■		■	■	■	■	■	■	■	■	■	■	■	■	■	14
Two-spotted clingfish		■		■	■	■	■	■	■	■	■	■	■	■	■	■	14
Three-spined		■			■	■	■	■	■	■	■	■	■	■	■	■	13
Butterfish		■		■		■	■	■	■	■	■	■	■	■	■	■	13
Common goby				■	■	■	■	■	■	■	■	■	■	■	■	■	13

Species	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Persistence
Sand goby				■	■	■	■	■	■	■	■	■	■	■	■	■	13
Grey mullet family				■	■	■	■	■	■	■	■	■	■	■	■	■	13
Scad/Horse mackerel				■	■	■	■	■	■	■	■	■	■	■	■	■	13
Painted goby				■	■	■	■	■	■	■	■	■	■	■	■	■	13
Rock goby				■	■	■	■	■	■	■	■	■	■	■	■	■	13
Common/ Dover sole		■	■	■	■		■	■	■	■	■	■	■			■	12
Bull-rout/ Short-spined		■		■	■	■	■	■	■	■	■	■			■	■	12
Garfish				■	■	■	■	■	■	■	■	■	■		■	■	12
European eel				■		■	■	■	■	■	■	■	■	■	■	■	12
Golden grey mullet					■	■	■	■	■	■	■	■	■	■	■	■	12
Montagu's sea snail				■	■	■	■	■	■	■	■		■	■	■	■	12
Solenette				■		■	■	■	■	■	■	■	■	■	■	■	12
Transparent goby	■			■			■	■	■	■	■	■	■	■	■	■	12
John Dory	■		■				■	■	■	■	■	■	■	■	■		11
Wrasse family		■		■	■	■	■		■		■	■	■	■	■		11
Goby genus (sand, common, painted)	■	■	■	■			■	■	■	■	■				■	■	11
Lesser sandeel		■			■		■	■	■	■	■	■	■		■	■	11
Gilthead bream						■	■	■	■	■	■	■	■	■	■	■	11
Thin-lipped grey mullet						■	■	■	■	■	■	■	■	■	■	■	11
Mackerel				■	■	■	■	■	■	■	■	■	■				10
Sandeel family		■			■	■	■	■	■	■	■	■	■				10
Brill		■	■			■	■	■	■		■	■	■		■		10
Pogge		■	■		■		■	■	■	■	■			■	■		10
Striped red mullet	■				■		■	■	■		■	■	■	■		■	10
Cod family		■				■	■	■	■		■		■	■	■	■	10
Worm pipefish	■		■				■		■	■	■		■	■	■	■	10
Pipefish family							■	■	■	■	■	■	■	■	■		9
Lesser weever				■	■	■	■	■	■				■	■			8
Pilchard				■			■	■	■	■	■	■	■				8
Sole family				■			■	■	■	■	■		■	■			8
Raitt's sandeel								■	■	■	■	■	■	■	■		8
Dragonet family						■	■		■		■	■	■		■	■	8
Sea lamprey								■	■	■	■	■	■			■	7
Sea trout					■			■	■	■	■	■				■	7
Reticulated dragonet					■		■	■			■		■	■			6
Scorpion fish family							■			■	■	■	■	■			6
Goldsinny wrasse								■	■	■	■		■			■	6
Sea snail family		■					■	■			■		■				5
Gurnard family		■			■		■					■	■		■		5
Smoothound					■		■				■	■	■				5
Clingfish family											■	■	■	■	■		5

Species	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Persistence
Common sea snail							■		■				■	■	■		5
Smooth sandeel					■	■						■			■	■	5
Lumpsucker								■	■	■	■						4
Triggerfish				■		■		■		■							4
Lozano's goby									■			■	■	■			4
Conger eel									■		■	■				■	4
Straight-nosed pipefish							■				■		■		■		4
Ling/rockling family											■		■	■		■	4
Long-snouted seahorse										■		■	■				3
Montagu's blenny		■					■		■								3
Saithe				■	■	■											3
Butterfly blenny						■							■	■			3
Tadpole fish											■			■	■		3
Cuckoo wrasse							■						■				2
Right-eyed flounder								■				■					2
Starry smoothound													■	■			2
Topknot		■						■									2
Greater sandeel													■	■			2
Rock cook			■												■		2
Silvery ling			■													■	2
Norway/ Longspined bullhead															■	■	2
Longspined bullhead															■	■	2
Three-bearded rockling			■														1
Corbin's sandeel												■					1
Baillon's wrasse									■								1
Crystal goby													■				1
Deep-snouted pipefish		■															1
Diminutive/Guillet's		■															1
Haddock										■							1
Halibut			■														1
Poor cod/Bib family								■									1
Red gurnard		■															1
Salmon family								■									1
Sand sole									■								1
Smelt		■															1
Lesser Pipefish															■		1
Yarrell's blenny																■	1
Sculpin family																■	1